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THE MONOGENEAN PARASITIES OF AFRICAN FISHES. X. TWO ADDITIONAL *DACTYLOGYRUS* SPECIES FROM SOUTH AFRICAN *BARBUS* HOSTS[1]

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The first African *Dactylogyrus* species were reported by Price and Gery (in press). At this time approximately 20 species of this genus are known from various regions of the continent.

This study consists of an account of two additional species of *Dactylogyrus* recovered from South African fishes. One of these, *D. myersi* new species, was recovered from the gills of *Barbus trimaculatus* Peters. The other, *D. varicorhini* Bychowsky (1957), was harbored by *Barbus kimberleyensis*. This latter dactylogyrid was initially reported as a parasite of *Varicorhinus capoeta* taken in the Soviet Union. Paperna (1961) recovered this monogenean species from both *Barbus canis* and *Varicorhinus damascinus* in Israel, both cyprinid species native to that country.

The occurrence of the same parasite species on different host genera separated by thousands of miles is deemed of sufficient importance to warrant discussion at a later point.

Materials and Methods: The authors extend their thanks to R. McC. Pott, Professional Officer, Provincial Fisheries Institute, Lydenburg, Republic of South Africa for donation of branchial materials utilized in this study and for identification of host species.

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Host specimens were captured by seine and/or gill nets. Branchial materials were frozen and then preserved in 3.5 percent formalin prior to shipment to the United States. Gills and recovered parasites were then treated as prescribed by Price (1966) and measurements made as recommended by Price and McMahon (1967). Appropriate measurements and illustrations were made with the aid of a calibrated filar micrometer ocular and a camera lucida, respectively. Anatomical terms employed were those recommended by Hargis (1958) and by Price and Arai (1967). Average measurements are given first, followed by minimum and maximum values enclosed in parentheses. All measurements are expressed in microns.

Research on Monogenea is steadily increasing. These parasites are being described from the fishes of many countries where monogenetic trematodes were previously unknown. A check of available recent literature indicates that well over 400 species have been described within the past 10 years. This figure becomes more meaningful when it is realized that less than 1000 species of Monogenea were known in 1957.

The senior author foresees an increasing number of taxonomic inconsistencies and other difficulties which could be considered a natural consequence of working in a difficult area of research. I firmly believe, however, that the situation would be vastly improved if all authors would include whole mount illustrations of new species.

In a letter some time back, Dr. W. J. Hargis, Jr. (Director, Virginia Institute of Marine Science, Gloucester Point, Virginia), mentioned the "hook and anchor" methods of many workers in Monogenea. After working with these parasites for some time, I now fully realize the import of this. I would like to recommend that future new species have no status unless a whole mount for each is provided. As a former "hook and anchor" worker, I now feel that merely depicting sclerotized structures constitutes at best an inadequate approach to taxonomic studies.

Dactylogyrus myersi new species

Host: *Barbus trimaculatus* Peters; family Cyprinidae.
Locality: Pongolo River, Lydenburg, Republic of South Africa.
Location of parasite on host: Gill filaments.

Number studied: 12.
Holotype: USNM Helm. Coll. No. 70561.
Paratype: USNM Helm. Coll. No. 70562.

Description: A dactylogyrid of moderate size, provided with a smooth cuticle, length 323 (298–339); greatest body width 94 (86–102), near midlength. Anterior cephalic lobes well-developed, lateral lobes vestigial. Pharynx prominent, quite muscular and subspherical in outline (both dorsal and ventral views). Two pairs of eyespots, all members about equal in size. Head organs (either side) consist of four glandular structures connected by a common duct; duct terminates in larger pharyngeal gland. Peduncle short and stout, with result that haptor is not well differentiated from body proper (Fig. 1: whole mount).

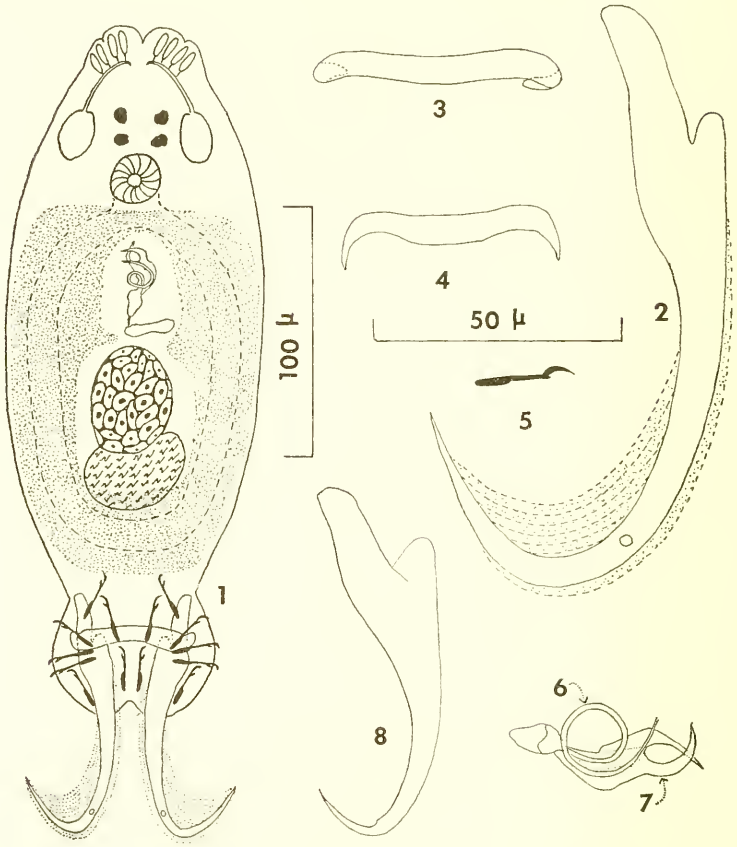
One pair of anchors (dorsal) (Fig. 2). Each anchor composed of: (1) a solid base equipped with well-defined deep and superficial roots, (2) a solid shaft and (3) a solid point; shaft and point meet in a continuous arc. A perforation occurs through anchor near junction of shaft and point. Anchors relatively long, *ca.* one-third as long as overall body length, anchor length 107 (100–112); width of base 18 (16–21). Anchor bases connected by a bar which is atypical for genus: ends are sheet-like and partially encircle anchor bases, length 47 (43–52) (Figs. 3, 4).

Haptoral hooks 14 (seven pairs), similar in shape and size (Figs. 1, 5) and arranged five pairs ventral on haptor, two pairs dorsal (Mizelle and Crane, 1964). Each hook composed of: (1) a solid elongate base, (2) a solid shaft and (3) a sickle-shaped termination provided with an opposable piece. Hooks range from 20 to 24 in length. The so-called "additional" hooks of *Dactylogyrus* (Mizelle and Price, 1963) are considered not to be hooks at all, but to be vestiges of a ventral pair of anchors, disappearing as evolution progressed. These structures were not observed in *D. myersi*.

Copulatory complex composed of a cirrus and a basally articulated accessory piece (Figs. 6, 7). Cirrus tubular, of a narrow diameter and arranged in a coil of *ca.* 1.5 turns; diameter of coil 25 (22–28). Accessory piece of unusual structure for genus; whereas most dactylogyrids possess accessory pieces with simple rami, those of the present form cross over each other distally. Length of accessory piece 28 (25–31). Testis postovarian, subspherical in outline and slightly smaller than ovary. Vas deferens appears to loop over intestinal limb, but not observed with certainty. Prostatic reservoir bipartite. Vagina not observed with certainty.

Intestine bifid, limbs simple and becoming confluent posteriorly. Vitellaria well-developed; co-extensive with intestinal crura.

Etymology: This species is named in honor of Dr. George S. Myers of the Division of Systematic Biology of Stanford University, in appreciation of the vast amount of ichthyological information he has furnished to the senior author.



FIGURES 1–7. *Dactylogyrus myersi* new species. 1, Entire worm (ventral view). 2. Anchor. 3, 4. Dorsal bar. 5. Hook. 6. Cirrus. 7. Accessory piece.

FIGURE 8. Anchor of *D. varicorhini* Bychowsky, 1957.

Discussion: Although *Dactylogyrus* can be considered a rather morphologically homogeneous group, the present new species does not appear to have any very close relatives. *D. myersi* possesses three characters which are considered to be atypical for *Dactylogyrus*: (1) a bar with modified ends which partially encircle the anchors, (2) relatively large anchors with a perforation near the junction of shaft and point and (3) an accessory piece in which one primary ramus crosses over the other.

Dactylogyrus varicorhini Bychowsky, 1957

Host: *Barbus kimberleyensis*; family Cyprinidae.
Locality: Pongolo River, Lydenburg, Republic of South Africa.
Number studied: Twenty-six.

Previously Reported Hosts and Localities: (1) *Varicorhinus capoeta*, in the Soviet Union, by Bychowsky (1957), (2) *Barbis canis*, in Israel, by Paperna (1961) and *Varicorhinus damascinus*, in Israel, by Paperna (1961).

Discussion: This species of *Dactylogyrus* is readily identified by reference to the anchors, which differ appreciably from those of the other approximately 375 species of this genus. An anchor is depicted in Fig. 8.

The specimens in our possession agree quite well with the morphological descriptions of *D. varicorhini* furnished by Bychowsky (1957) and Paperna (1961). In size, our specimens are intermediate between those described by these authors.

As noted above, *D. varicorhini* has been recovered from species of the cyprinid genera *Varicorhinus* (Soviet Union and Israel) and *Barbus* (Israel and South Africa). It is interesting to note that a given species of parasite occurs on different host genera which are separated by thousands of miles.

In a similar situation (Price and Yurkiewicz, in press) several specimens of the monogenean genus *Dogielius* Bychowsky (1936) were recovered from host specimens belonging to the genus *Labeo* in South Africa. The original report by Bychowsky concerned the host genus *Schizothorax*. The African and Soviet forms were separated by thousands of miles, as in the case of *Dactylogyrus varicorhini*. Paperna (1961) reported *Dogielius* from *Varicorhinus* in Israel.

One possible explanation for the occurrence of specific parasites on widely separated hosts involves early stages in the evolution of cyprinid fishes. Many ichthyologists believe that the cyprinids (family Cyprinidae) had their origin in Asia (Norman and Greenwood, 1963; Lagler, Bardach and Miller, 1962). These fishes likely evolved from a characoid ancestor. As Myers (1967) put it: "Cyprinoid fishes evolved in Asia from some toothless characoid which got across the Tethys from Africa. In Eurasia, the cyprinids blossomed into the largest familial group of the Ostariophysi, and in the Tertiary invaded both Africa (across the greatly shrunken Tethys) and North America (via a Bering land bridge)."

As the cyprinids underwent a veritable explosion of speciation, certain of them apparently migrated toward Europe and the Northwestern part of the Soviet Union. Others, as Myers (*op. cit.*) pointed out, crossed what remained of the Tethys Sea into Africa. It is conceivable that an ancestral minnow gave rise to two similar groups; one group headed northwest, the other southwest. The ancestral form was likely a *Barbus*-like form; offspring gave rise to *Barbus* as we know the genus today. This genus maintained its identity and also gave rise to both *Schizothorax* and *Varicorhinus*.

Parasitological inference is that the genera *Schizothorax*, *Varicorhinus* and *Barbus* are quite closely related. Paperna (1961) concurs in this. Crass (1964) places some doubt upon the validity of *Varicorhinus*, believing that the genus might well be synonymous with *Barbus*.

If it is accepted that the cyprinid genera above are very closely related, there remains only the necessity of accepting the well-established tenet of parallel evolution that similar hosts harbor similar parasites to theortically account for the wide-spread occurrence of the parasites discussed here.

Literature Cited

Bychowsky, B. E. 1936. Die Monogeneitschen Trematoden der Fische des Tschu-Flusses. Trav. Exped. et Republ. Kirghiz, Moscow. 3: 245–275.

———. 1957. Studies on Monogenoidea from Tadjikistan fishes. (Russian text, with German summary). Isv. Vsiess. Nauchn. Issl. Inst. Osior i Riechn. Rybn. Khos. 42: 109–123.

Crass, R. S. 1964. Freshwater fishes of Natal. Shutter and Shooter. Pietermaritzburg, South Africa. 167 p.

Hargis, W. J., Jr. 1958. A revised, annotated list of terms useful for morphological studies of monogenetic trematodes. (Mimeographed at Virginia Marine Laboratory, Gloucester Point, Virginia. 12 pp.)

Lagler, K. F., J. E. Bardach, and R. R. Miller. 1962. Ichthyology. John Wiley and Sons, Inc. New York. 545 p.

Mizelle, J. D., and J. W. Crane. 1964. Studies on monogenetic trematodes. XXIII. Gill parasites of *Micropterus salmoides* (Lacépède) from a California pond. Trans. Amer. Microscop. Soc. 83: 343–348.

———, and C. E. Price. 1963. Additional haptoral hooks in the genus *Dactylogyrus*. J. Parasitol., 49(6): 1028–1029.

Myers, G. S. 1967. Zoological evidence of the age of the South Atlantic Ocean. Studies in Tropical Oceanography. Miami, 5: 614–621.

Norman, J. R., and P. H. Greenwood. 1963. A history of fishes. Hill and Wang, New York. 398 p.

Paperna, I. 1961. Studies on monogenetic trematodes in Israel. 3. Monogenetic trematodes of the Cyprinidae and Claridae of the Lake of Galilee. Bamidgeh, 13(1): 14–29.

Price, C. E. 1966. *Urocleidus cavanaughi*, a new monogenetic trematode from the gills of the keyhole cichlid, *Aequidens maroni* (Steindachner). Bull. Georgia Acad. Sci., 24: 117–120.

———, and H. P. Arai. 1967. A proposed system of anatomy for freshwater Monogenea. Canadian J. Zool., 45(6): 1283–1285.

———, and T. E. McMahon. 1967. The monogenetic trematodes of North American freshwater fishes. Riv. Parassit., 28: 177–220.

———, AND J. GERY. (In press). Parasites des Poissons du Gabon. I. Generalites sur les Trematodes monogenetiques, et description de six nouvelles especes parasites du genre *Barbus*. Biologica Gabonica.

———, AND W. J. YURKIEWICZ. (In press). The monogenean parasites of African fishes. VIII. A re-evaluation of the genus *Dogielius* Bychowsky, 1936, with the description of a new species. Rev. Iberica Parasitol.